ADDICTION
SSA SOCIETY FOR THE STUDY OF ADDICTION
RESEARCH REPORT
doi:10.1111/add.15451

# Evaluating the effects of the Licensing Act 2003 on the characteristics of drinking occasions in England and Wales: a theory of change-guided evaluation of a natural experiment

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## ABSTRACT

**Background and Aims** The Licensing Act 2003 deregulated trading hours in England and Wales. Previous evaluations have focused upon consumption and harm outcomes, finding mixed results. Several evaluations speculated on the reasons for their results, noting the role of changes in the characteristics of drinking occasions. This study aimed to test proposed mechanisms of effect for the Licensing Act 2003 by evaluating changes in characteristics of drinking occasions. Design, Setting and Participants Interrupted monthly time–series analysis of effects in England and Wales versus a Scottish control series, using 2001–08 data collected via 7-day drinking occasions diaries by the market research company Kantar ($n$ = 89 192 adults aged 18+). **Measurements** Outcomes were start- and end-time of each reported occasion; variation in finish time; prevalence of pre-loading, post-loading and late-night drinking; and alcohol consumption (in units). **Findings** After the introduction of the Act, occasions shifted later at night in England and Wales [finish time +11.4 minutes; 95% confidence interval (CI) = 3.6–19.2]. More occasions involved pre-loading in England and Wales relative to Scotland (0.02% increase; 95% CI = 0.01–0.03). There was no evidence of changes in variation in finish time, post-loading, late-night drinking or alcohol consumption. **Conclusions** The Licensing Act 2003 in England and Wales appears to have had only limited effects on the characteristics of drinking occasions. This may help to explain its lack of substantial impacts on alcohol harms

**Keywords** Alcohol, Contexts, Drinking occasions, Health policy, Natural experiment, Time series analysis.

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Submitted 4 March 2020; initial review completed 28 July 2020; final version accepted 10 February 2021

## INTRODUCTION

Controlling the spatial and temporal availability of alcohol is one of the most effective ways of reducing alcohol consumption and related harm [1]. In countries such as England and Wales, availability is controlled through a system of licenses permitting the sale of alcohol [1]. In England and Wales, licensing is currently regulated under the Licensing Act 2003 (implemented in November 2005), which liberalized licensing policy to help regenerate struggling local economies and encourage a shift towards a more 'European-style café culture' [2,3]. The Act has been criticized from a public health perspective, as the international literature suggests that extending licensing hours may increase alcohol-related harm [4–7].

The Act made a number of changes, including moving responsibility for licensing to newly formed licensing committees, which include elected members of local councils, and restricting the ability of licensing authorities to withhold licenses or restrict trading behaviours [8,9]. The most widely discussed change was the liberalization of both on- and off-trade alcohol outlet trading hours, which had previously ended at 11 p.m. for most outlets [8–10]. The Act removed fixed licensing hours in England and Wales;

premises were allowed to apply for and receive licenses to trade for longer periods up to 24 hours a day unless licensing authorities could demonstrate that this would undermine one of the four newly introduced licensing objectives (the prevention of crime and disorder; public safety; the prevention of public nuisance; and the protection of children from harm) [9,11,12]. Although public debate around the Act focused upon the possibility of 24-hour drinking, the changes that actually occurred were less dramatic than those enabled by the legislation [12,13]. Some premises already traded after 11 p.m. under Special Hours Certificates as a result of previous liberalization processes [13]. Furthermore, only a small number of premises applied for 24-hour licenses, but approximately 80% of venues extended their opening hours past the previous standard closing time of 11 p.m. [12].

Existing evaluations of the Act have mixed findings, with some studies finding increases in violent crime and emergency department attendance following implementation while others find that violence, emergency department attendance and alcohol-related traffic accidents decreased or did not change significantly [3,11,13–18]. Some existing evaluations were not able to adjust for all important confounding factors or lacking adequate pre-implementation data [5,19]. Existing evaluations also largely focus upon harm outcomes such as violent crime and emergency department attendance. There is a lack of evaluation examining proximal outcomes; for example, changes in characteristics of drinking occasions (e.g. the timing or location of alcohol consumption) which produce distal outcomes such as consumption and alcohol-related harm. Several evaluations speculated on the reasons for their results, noting the possible role of changes in the characteristics of drinking occasions [12,15,20–23]. These occasion characteristics are of increasing public health interest, as a growing literature suggests that they are associated with levels of consumption and acute alcohol-related harm within drinking occasions [24]. Consideration of occasion characteristics can help to understand the changes that occurred, add clarity to mixed findings on the effects of the Act and inform future policymaking [25,26].

This study therefore aims to test mechanisms of effect for the Licensing Act 2003 by evaluating changes in the characteristics of drinking occasions.

## METHODS

### Hypotheses

We iteratively developed a set of hypotheses for the possible effects of the Licensing Act 2003 on drinking occasions, based on explanations proposed in previous evaluations and informal discussion with stakeholders (Table 1) [11,19,27,28]. This analysis was not pre-registered, and the results should be considered exploratory.

### Research design

In line with these hypotheses, we analysed the effect of the Licensing Act 2003 on the timing, location and level types of alcohol consumption during drinking occasions using autoregressive moving average (ARMA) models and controlled interrupted time–series methods. This is a quasi-experimental design that makes efficient use of the natural experiment of the Act being introduced [30]. We used data from Scotland to control for time-varying confounders under the assumption that these followed similar time trends throughout Great Britain [31].

### Data

We used data from the 2001–08 Alcovision survey, which is collected by Kantar Worldpanel, a market research company. Alcovision is a continuously collected cross-sectional survey that includes measures of usual alcohol consumption, socio-demographic variables and a detailed 7-day retrospective drinking diary.

The sample was an in-street quota sample based on age, sex, social grade and geographic region of ~12 500 adults per year (18+) in Great Britain. The present analysis includes 185 772 drinking occasions nested within 89 192 respondents who reported drinking during the diary week. All participants gave their informed consent prior to inclusion in the survey. Great Britain census-derived weights based on age, sex, social grade and geographic region are used.

The diary begins by identifying those days in the last week on which the respondent drank in off-trade (e.g. drinking at home) or on-trade (e.g. pubs, restaurants) locations. Participants describe the characteristics of up to two off- and two on-trade occasions per day, including who they were with, the reason for the occasion and what type of alcohol they drank. As real-world drinking occasions can span on- and off-trade locations, we define occasions differently as periods of drinking with no more than a 2-hour gap between drinks.

### Measures

#### *Outcome measures*

We have nine outcome measures split across four domains: timing, pre- and post-loading, alcohol consumption and demographic groups involved in late-night drinking occasions. The timing measures are start and finish time of each occasion and standard deviation of finish time of all occasions. The alcohol consumption measures are drinking speed (units/hour) and on- and off-trade consumption. Finally, we measure the proportion of all occasions that are late-night drinking occasions. To address our hypotheses, we analyse these outcomes among pre-specified subgroups

 

**Table 1** Table of hypotheses.

| *Hypothesis* | *Rationale and sources* | *Outcome measure* | *Support from results* |
|---|---|---|---|
| 1. Timing | | | |
| H1a. Occasions finish later, especially at the weekend | Previous evaluations hypothesized that because fewer venues closed at a standard closing time (11 p.m.) customers may have left on-trade venues later [12,15,20] This is expected to be most pronounced at the weekend, where there were greater changes in trading hours [12,15]. The timing of off-trade drinking occasions may also have changed as alcohol became available later at night [12] | Mean occasion finish time (start time + occasion length) | Partially |
| H1b. More variation in finish times (increased standard deviation) | It has been hypothesized by previous evaluations that the closing times of venues became more varied so people may have left on-trade venues at more varied times [15,20] | Standard deviation of occasion finish time | No |
| H1c. On-trade and mixed on/off-trade occasions started at a similar time and finished later (tested separately) especially at the weekend and for those aged under 25 years | Drinking occasions may have continued to start at a similar time (with a possible shift towards starting in the off-trade) while ending later [21]. These changes may be more pronounced among under 25-year-olds, as there is evidence suggesting that their drinking occasions start at a constant time at the weekend and they are generally likely to pre-load [21,23] | Mean occasion start and finish times | Partially |
| 2. Pre- and post-loading | | | |
| H2a. There were more mixed location occasions which started in the off-trade and proceeded to the on-trade, especially at the weekend and for those aged under 25 years | Longer opening hours of on-trade venues may have encouraged people to drink in the off-trade first (pre-loading) as alcohol is cheaper and there would still be plenty of time to drink in the on-trade later [22]. These changes may be more pronounced among under 25-year-olds as there is evidence suggesting that their drinking occasions start at a constant time at the weekend and they are generally likely to pre-load [21,23] | Proportion of occasions which began in the off-trade and proceeded to the on-trade | Partially |
| H2b. There were fewer mixed location occasions which started in the on-trade and proceeded to the off-trade | It may have become less common to move to the off-trade after on-trade drinking as on-trade drinking could continue later at night | Proportion of occasions which began in the on-trade and proceeded to the off-trade | No |
| 3. Alcohol consumption | | | |
| H3a. The same number of units were drunk per hour in on-trade and mixed location occasions, which led to higher mean consumption per occasion if H1c is supported | Given a stable rate of consumption, longer occasions may have led to higher overall consumption [29] | Mean number of units drank in the on-trade per occasion | No |

(*Continues*)

**Table 1.** (Continued)

| *Hypothesis* | *Rationale and sources* | *Outcome measure* | *Support from results* |
|---|---|---|---|
| H3b. Mean off-trade consumption per occasion increased | The Act also removed restrictions on trading hours for off-trade sales, but hypothesizing the effects of this is not straightforward, as alcohol can be bought in the off-trade in advance of the drinking occasion. Nonetheless, we hypothesize that longer off-trade trading hours may have led to increased consumption in off-trade drinking occasions, as people could buy more alcohol and continue drinking later at night [1] | Mean number of units drank in the off-trade per occasion | No |
| 4. Demographic groups involved in late-night drinking occasions | | | |
| H4a. More drinking occasions of over 25s started after 11 p.m. | A greater proportion of over 25s' drinking occasions may have been late-night drinking due to this greater variety of available venues | Proportion of occasions which started after 11 p.m. | No |
| H4b. More drinking occasions of full-time employees started after 11 p.m., especially at the weekend | People in full-time employment are expected to have late-night drinking occasions at the weekend, as they are typically working during the week | Proportion of occasions which started after 11 p.m. | No |

selected by age, drinking location (on-, off-, mixed on- and off-trade locations), weekend versus weekday and employment status. We used weighted data from all occasions within the sample to calculate population-representative monthly time–series of average values of the outcome variables. We excluded respondents who did not report any drinking during the diary week.

Start times of each occasion are measured in bands, such as 14:00–17:00 and 19:00–20:00 hours; we use the earliest time in each band for analyses. The finish time of each occasion is calculated by adding the occasion length to the start time. Occasion length is measured in bands of 1 hour until the highest band, which is '8 or more hours'. We use mid-points to create point-estimates and use a value of 8 hours and 30 minutes for the highest band. We also use standard deviation of occasion finish times, which we use to assess variation in finish times.

Pre-loading occasions are when alcohol is consumed first in the off-trade (e.g. at home) and then the on-trade (e.g. a pub) and vice versa for post-loading occasions. We measure this as the monthly proportion of occasions that involve pre-loading. The proportion of post-loading occasions is calculated in the same way.

Units are calculated from variables recording serving size, number of servings consumed and alcohol by volume. We used units to construct three consumption outcome measures: the mean number of units drank per hour in each drinking occasion (drinking speed), the mean number of units consumed in the on-trade per occasion (on-trade consumption) and the mean number of units consumed in the off-trade per occasion (off-trade consumption).

Our final domain related to late-night drinking. The main outcome measure is the proportion of occasions that are 'late-night'. We hypothesized that more occasions started after 11 p.m., but the Alcovision survey collects data on occasion start times in bands starting at 10 p.m. and midnight, and therefore we decided a priori to define late-night occasions as those starting after midnight. We conducted a sensitivity analysis defining late-night occasions as starting after 10 p.m.

### *Licensing act 2003*

Models included a dummy variable representing the Licensing Act 2003 (to evaluate whether there was a step change in the outcome variable in November 2005 when the Act was implemented) and an interaction term of this dummy variable with the monthly time term (to evaluate whether there was a slope change in the outcome variable). The coefficients of the step change and slope variables are the key results of interest for each model. Step changes indicate an immediate change in the outcome measure; for example, an increase in the variation of

 

drinking occasion finish times in November 2005. Slope changes indicate a change in the trend of the outcome measure. For example, mean finish times could have been getting gradually earlier from 2001 but then shown a change in trend and started shifting later at night from November 2005 onwards.

*Stratifying variables*

To test our hypotheses, we also use stratifying variables including age (under and over 25 years) and employment status (whether in full-time employment). The Alcovision survey asks respondents to give their age in years and employment status is measured by the question: 'Can you please indicate your employment status?', with 13 response options, e.g. 'working full-time (30+ hours)' or 'unemployed more than 11 months'. Respondents also report the day of the week for each drinking occasion, and we use this to identify weekend drinking—defined as Fridays and Saturdays.

### Statistical analysis

To specify our ARMA models, we used autocorrelation and partial autocorrelation plots to identify autocorrelation of the model residuals for each outcome measure and corrected it using autoregressive terms where necessary. We accounted for trend and seasonality in the time–series by including year and dummy variables for the calendar month as predictors. We included a squared term for the year (to model non-linear time trends) where this was significant at $\alpha = 0.05$. In order to control for time-varying confounders, we modelled the series created by subtracting the monthly series of each variable in Scotland from the monthly series in England and Wales. The resulting series is referred to as the 'differenced' series.

We modelled each outcome variable separately in both England and Wales, and Scotland, before modelling the differenced series. A change in the differenced series will occur when there is a change in England and Wales that did not take place in Scotland and vice versa. The underlying assumption is that trends in time-varying confounders do not differ between England and Wales, and Scotland, and remain stable before and after the introduction of the Licensing Act. We assessed whether the time–series differ between England and Wales versus Scotland prior to the Licensing Act 2003 by using linear regression to test for trends in the pre-intervention differenced series (Supporting information, Appendix A). All analyses were conducted using Stata version 15.

### Ethics approval

This study was approved by the University of Sheffield's ethics committee and conforms to the principles embodied in the Declaration of Helsinki. Use of this data is allowed under the terms of the contract and non-disclosure agreement between Kantar and the University of Sheffield, which requires research outputs to be submitted to the data provider ahead of publication. The data providers' right to request changes is limited to matters of accuracy regarding descriptions of the Alcovision survey data.

### Role of the funding source

The funders of the study had no role in the study design, data collection, data analysis, data interpretation or writing of the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

## RESULTS

To provide context for the results, mean values for main outcome measures based on the full monthly time–series are shown in Table 2. The results of all models can be found in the Supporting information tables.

*Timing*

H1a: *Occasions finish later, especially at the weekend.*

When checking whether the trends are parallel between mean monthly finish time in England and Wales versus Scotland, we found diverging trends in the period prior to the Licensing Act 2003 (Supporting information, Appendix A). Due to this, it is difficult to interpret the analysis of the differenced series, as data from Scotland may not provide a robust control.

Immediately following the Act, the mean finish times of drinking occasions moved to later in the evening in England and Wales (+11.4 minutes; 95% CI = 3.6–19.2; Supporting information, Table S1). This shift was more pronounced for on-trade or mixed drinking occasions at the weekend (+31.8 minutes; 95% CI = 17.4–45.6; Supporting information, Table S3), while there was no significant change in the mean finish time for off-trade drinking occasions at the weekend (Supporting information, Table S5). It is not clear whether these changes were due to the Licensing Act 2003, as data from Scotland cannot be used as a robust control.

H1b: *More variation in finish times.*

There was a small step change in the standard deviation of monthly occasions finish times in England and Wales (+4.8 minutes; 95% CI = 0.0–10.2) and a slope change (+0.6 minutes per month; 95% CI = 0.0–0.6) following the introduction of the legislation, which was not observed in Scotland. However, the findings for the differenced series showed no significant effect of the Act (Fig. 1, Table 3, Supporting information, Table 1).

 

**Table 2** Mean values of main outcome measures based on full monthly time–series (2001–08).

| *Outcome measure* | *England and Wales* | *Scotland* |
|---|---|---|
| 1: Timing | | |
| Finish time | 19:47 | 20:35 |
| Finish time, standard deviation | 3.11 | 2.87 |
| Start time for on-trade or mixed drinking occasions | 17:08 | 17:17 |
| Finish time for on-trade or mixed drinking occasions | 20:17 | 20:47 |
| 2: Pre- and post-loading | | |
| Proportion of pre-loading occasions (%) | 2.46 | 2.89 |
| Proportion of post-loading occasions (%) | 1.44 | 1.18 |
| 3: Alcohol consumption | | |
| Drinking speed (units/hour) for on-trade or mixed drinking occasions | 3.09 | 3.29 |
| On-trade consumption (units/occasion) | 2.69 | 3.39 |
| Off-trade consumption (units/occasion) | 3.54 | 4.35 |
| 4: Range of venues and demographic groups involved in late-night drinking occasions | | |
| Proportion of late drinking occasions of over 25-year-olds (%) | 0.32 | 0.26 |
| Proportion of late drinking occasions of those in full-time employment during the week (%) | 0.40 | 0.09 |
| Proportion of late drinking occasions of those in full-time employment at the weekend (%) | 0.55 | 0.26 |

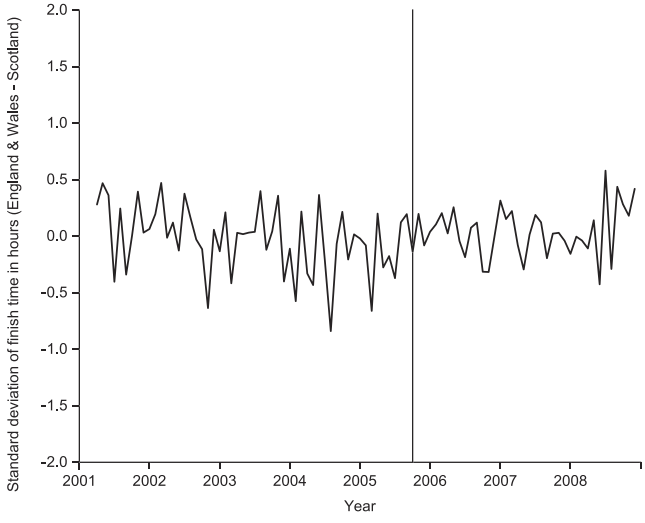


**Figure 1** Monthly de-seasonalized standard deviation of mean occasion finish time, differenced England and Wales minus Scotland. Vertical line = implementation of the Licensing Act 2003, November 2005

H1c: *Later finish but same start for on-trade and mixed location occasions, especially young peoples' and weekend drinking.*

On-trade and mixed location occasions in England and Wales became longer after the implementation of the Act, driven by the step change in mean finish times (+22.2 minutes; 95% CI = 8.4–35.4). Mean start and finish times both showed changes in slope towards later in the evening, shifting occasions later at night but overall not contributing to the increased duration, as the changes in slope were similar for mean start and finish times (Supporting information, Table S4).

In Scotland, occasions also became longer because of a step change in finish times (+28.2 minutes; 95% CI = 7.8–48.0). However, in contrast to England and Wales, a trend towards earlier mean start and finish times was observed in Scotland, shifting occasions earlier overall (Supporting information, Table S4). The impact of the introduction of the Act, as modelled based on the differenced series, indicated a significant slope change towards later start times (Fig. 2, Table 3), suggesting that the Act contributed to occasions shifting later at night in England and Wales.

The pattern of results was broadly similar for on-trade and mixed drinking occasions at the weekend in England and Wales, and Scotland, but the changes were not significant in the differenced series (Supporting information, Table S3). On-trade or mixed drinking occasions of under 25-year-olds again showed a similar pattern of results (Supporting information, Table S2).

 

**Table 3** Key differenced series results.

| | | | | | |
|---|---|---|---|---|---|
| *1: Timing* | | | | | |
| Finish time | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | P | B | 95% confidence interval | *P* |
| −0.01 | −0.29 to 0.26 | 0.92 | 0.03 | 0.02 to 0.04 | 0.00 |
| Finish time, standard deviation | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.18 | −0.04 to 0.41 | 0.10 | 0.01 | 0.00 to 0.02 | 0.08 |
| Start time for on-trade or mixed drinking occasions | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| −0.22 | −0.62 to 0.18 | 0.28 | 0.02 | 0.00 to 0.03 | 0.02 |
| Finish time for on-trade or mixed drinking occasions | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| −0.21 | −0.67 to 0.26 | 0.38 | 0.02 | 0.01 to 0.04 | 0.01 |
| 2: Pre- and post-loading | | | | | |
| Proportion of pre-loading occasions | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.02 | 0.01 to 0.03 | 0.00 | 0.00 | −0.00 to 0.00 | 0.22 |
| Proportion of post-loading occasions | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.00 | 0.00 to 0.01 | 0.53 | 0.00 | −0.00 to 0.00 | 0.61 |
| 3: Alcohol consumption | | | | | |
| Drinking speed (units/hour) for on-trade or mixed drinking occasions | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| −0.19 | −0.56 to 0.18 | 0.31 | 0.00 | −0.01 to 0.02 | 0.73 |
| On-trade consumption | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.11 | −0.47 to 0.70 | 0.70 | 0.00 | −0.03-0.02 | 0.82 |
| Off-trade consumption | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.08 | −0.36 to 0.51 | 0.72 | −0.01 | 0.00 to 0.03 | 0.15 |
| 4: Range of venues and demographic groups involved in late-night drinking occasions | | | | | |
| Proportion of late drinking occasions of over 25-year-olds | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.00 | −0.01 to 0.00 | 0.63 | 0.00 | −0.00 to 0.00 | 0.50 |
| Proportion of late drinking occasions of those in full-time employment during the week | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.00 | 0.00 to 0.01 | 0.51 | 0.00 | −0.00 to 0.00 | 0.82 |
| Proportion of late drinking occasions of those in full-time employment at the weekend | | | | | |
| Step change | | | Slope change | | |
| B | 95% confidence interval | *P* | B | 95% confidence interval | *P* |
| 0.00 | −0.01 to 0.00 | 0.04 | 0.00 | –0.00 to 0.00 | 0.84 |

Differences = differenced series created by subtracting the Scotland series from the England and Wales series. B = regression coefficient; *P* = *P*-value. All outcome measures are monthly series of weighted drinking occasion characteristics. Start time, finish time, drinking speed, on-trade consumption and off-trade consumption are monthly averages. Finish time = standard deviation is monthly weighted standard deviations of occasion finish times. Pre-loading occasions are when alcohol is consumed in the off-trade (e.g. at home) and then the on-trade (e.g. a pub) and vice versa for post-loading occasions. Proportion of pre-loading occasions is the monthly weighted number of pre-loading occasions as a proportion of the weighted number of total occasions that month. Proportion of post-loading occasions and late drinking occasions are calculated in the same way. Late drinking occasions are defined as occasions starting after midnight. Drinkers are those who consumed at least one alcoholic beverage during the diary week.

 

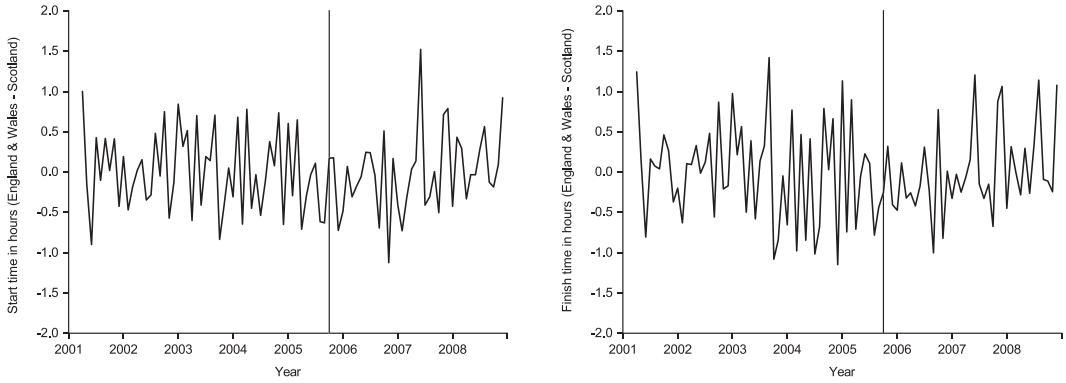


**Figure 2** Monthly de-seasonalized mean on-trade or mixed occasion start time and finish time, differenced England and Wales minus Scotland. Vertical line = implementation of the Licensing Act 2003, November 2005

*Pre- and post-loading*

H2a: *More pre-loading, especially young peoples' and weekend drinking.*

There was a step change towards less pre-loading in Scotland (−0.02% of occasions involving pre-loading; 95% CI = −0.03 to 0.00) and pre-loading increased by 0.01% (95% CI = 0.00–0.01) in England and Wales (Supporting information, Table S1). The estimated effect of the Act was significant (+0.02% of occasions involving pre-loading; 95% CI = 0.01–0.03) (Fig. 3, Table 3). This change was of a similar magnitude at the weekend and among under 25-year-olds (Supporting information, Tables S6 and S7). There was no significant slope change in the differenced series.

H2b: *Fewer mixed location occasions that started in the on-trade and finished in the off-trade.*

There were no significant changes in the proportion of post-loading occasions based on the differenced series (Fig. 3, Table 3, Supporting information, Table S1).

*Alcohol consumption*

H3a: *Speed of drinking remains constant, leading to higher per-occasion consumption.*

Average drinking speed in on-trade and mixed location occasions fell in both England and Wales (−0.18 units per hour; 95% CI = −0.38 to 0.02) and Scotland (−0.37 units per hour; 95% CI = −0.73 to –0.01) (Supporting information, Table S4). There was no significant change in the differenced series, suggesting that the decrease in England and Wales may not be attributable to the Act (Fig. 4, Table 3).

As previously discussed, occasions in England, Wales and Scotland became longer after the implementation of the Act. However, because this was combined with a similarly sized reduction in drinking speed across England, Wales and Scotland, there was no change in mean consumption per on-trade occasion in the differenced series (Fig. 4, Table 3, Supporting information, Table S1).

H3b: *Overall consumption in off-trade occasions increased.*

There was no significant step change or change in slope for mean off-trade consumption per occasion in England

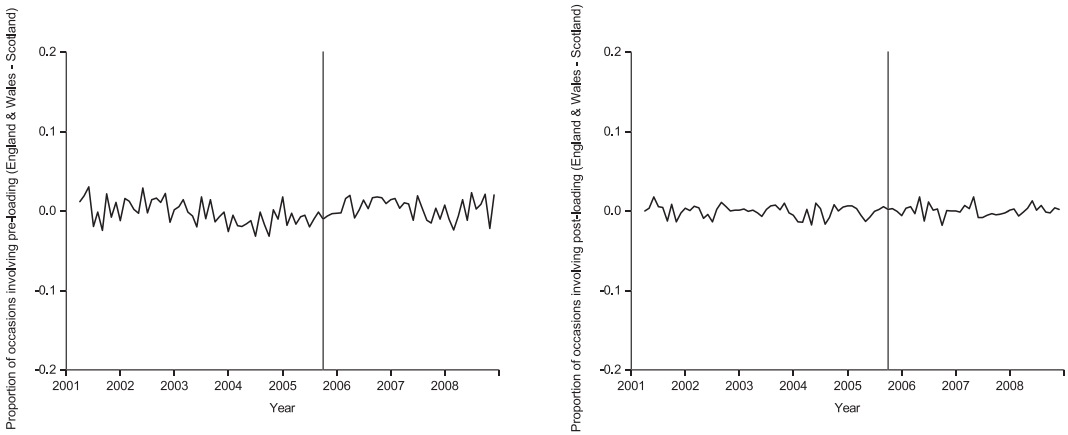


**Figure 3** Monthly de-seasonalized proportion of occasions involving pre-loading and post-loading (%), differenced England and Wales minus Scotland. Vertical line = implementation of the Licensing Act 2003, November 2005

 

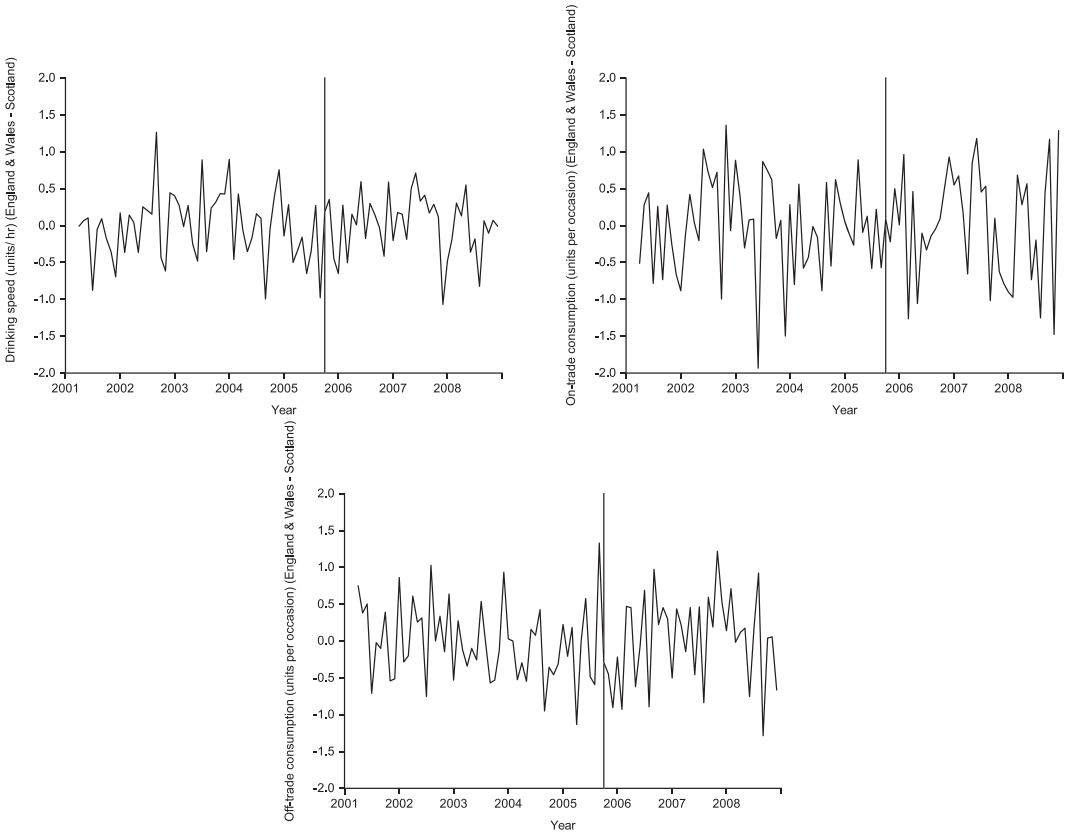


**Figure 4** Monthly de-seasonalized mean drinking speed (units/hour) of on-trade or mixed drinking occasions, on-trade consumption and off-trade consumption, differenced England and Wales minus Scotland. Vertical line = implementation of the Licensing Act 2003, November 2005

and Wales or Scotland (Fig. 4, Table 3, Supporting information, Table S1).

*Demographic groups involved in late-night drinking occasions*

H4a: *More drinking occasions of over 25s were late-night drinking (after 11 p.m.).*

None of the models showed a significant step change or change in slope for the proportion of late drinking occasions among over 25-year-olds after the Act (Fig. 5, Table 3, Supporting information, Table S8). This result did not change in the sensitivity analysis, where late-night drinking was defined as occasions starting after 10 p.m.

H4b: *More drinking occasions of full-time employees were late-night drinking, especially at the weekend.*

There was only one significant change in the differenced series (a step change), suggesting that those in full-time employment had marginally more late-night drinking occasions at the weekend in Scotland relative to England and Wales (Fig. 6, Table 3, Supporting information, Table 9). This contradicts the hypothesis. This change was not seen in the sensitivity analysis, which instead found that those in full-time employment had marginally more late-night drinking occasions during the week in England and Wales relative to Scotland.

## DISCUSSION

Our paper evaluated the effects of trading hours deregulation in England and Wales by systematically testing different mechanisms at the occasion-level by which such policies were hypothesized to affect consumption and harm. These mechanisms were based on explanations proposed in previous evaluations and informal discussion with stakeholders for the mixed and often inconclusive evaluation results generated to date [11,13–15]. We found limited evidence that the Licensing Act 2003 had the hypothesized effects on drinking occasion characteristics. Relative to Scotland, there was a trend towards later start times in England and Wales, and the proportion of drinking occasions involving pre-loading also increased. Further, finish times of drinking occasions shifted later in England and Wales. However, there was no measurable change in the proportion of occasions involving post-loading, no evidence of increased variation in occasion finish times and no increase in the proportion of over 25s' or full-time

 

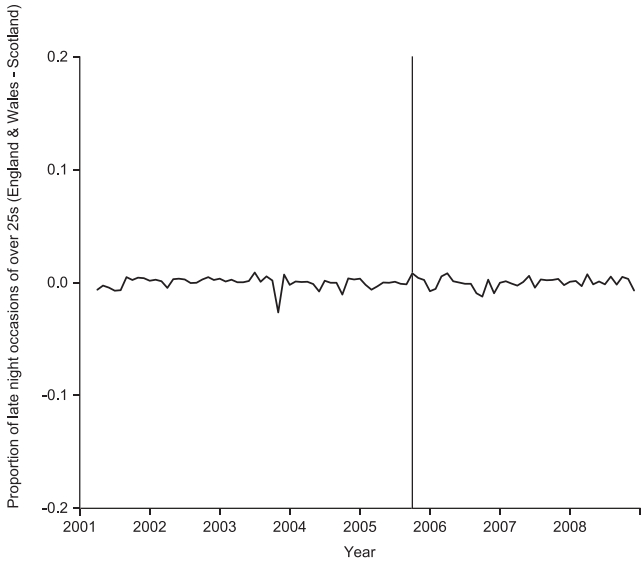


**Figure 5** Monthly de-seasonalized proportion of late-night occasions of over 25s (%), differenced England and Wales minus Scotland. Vertical line = implementation of the Licensing Act 2003, November 2005

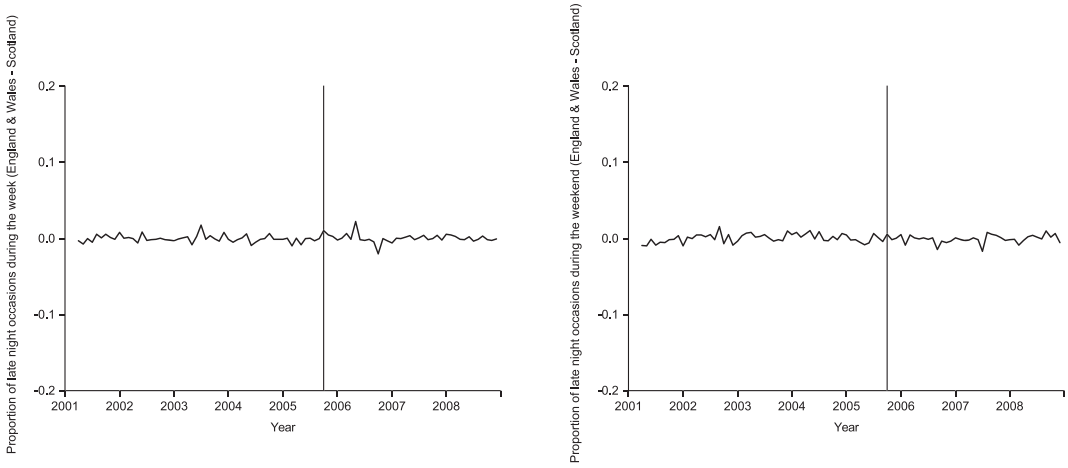


**Figure 6** Monthly de-seasonalized proportion of late-night occasions of full-time employees during the week and the weekend, differenced England and Wales minus Scotland. Vertical line = implementation of the Licensing Act 2003, November 2005

employees' drinking occasions starting after 11 p.m. We also did not find measurable effects of the Act on drinking speed, occasion duration or alcohol consumption in the occasion. Our results go some way towards explaining why previous authors have not observed the expected major public health effects of the Act on alcohol consumption or harm. Given our results, which only indicated small changes in the timing of occasions, we would only expect a possible (small) shift of acute problems and social disorder later into the night.

Our findings provide some insight into the possible role of changes in the characteristics of drinking occasions in the effects of the Licensing Act 2003. For example, two papers by Green *et al.* hypothesized occasion-level mechanisms based on their findings; specifically, that (1) decreased road traffic accidents were due to the increased variation in drinking occasion finish times, as fewer impaired drivers would be on the road at one time, and that (2) increased absenteeism was due to drinking hours shifting later at night, and therefore closer to working hours [3,32]. Our findings did not support the hypothesis that finish times of drinking occasions became more varied, but we found some evidence supporting the hypothesis that drinking hours shifted later at night.

A possible reason for the lack of effect on proximal outcomes is that the Licensing Act 2003 may have only had limited impact on actual trading hours due to earlier liberalization processes and the existing widespread availability of late-night drinking opportunities prior to the Act [13]. Although the international literature suggests that extending trading hours increases alcohol-related harm, our evidence, in agreement with other evaluations from the

 

United Kingdom, suggest that the specific nature of regulatory changes is important [4–7,11,13–15]. For instance, the Act shifted responsibility for licensing to licensing committees, which was intended to facilitate partnership-working between local authorities and the police, and may have mitigated the effects on harmful drinking behaviours of relaxing trading hours restrictions [12].

The Alcovision survey provides unique data on changes in drinking occasion characteristics over time, allowing us to evaluate proximal impacts of the Act on drinking occasions. A further strength is the availability of data from Scotland, where a similar policy was not implemented until several years later, as a control time–series. However, our evaluation of effects relies upon the assumption that correlations between both time–series do not differ over time and remained constant before and after the introduction of the Act (with the exception of effects as a result of the introduction itself). Our data on the start time and duration of drinking occasions are measured in bands, which reduces the precision of analyses using these outcomes. Until 2009, Alcovision data was collected using in-street quota sampling, which has known limitations [33–35]. Participant selection is non-random and surveys were conducted face-to-face, so there is a greater chance of selection bias and social desirability bias [33,34]. Survey methods are also known to under-represent heavy drinkers and typically under-report consumption levels compared to sales and taxation data [35]. A further limitation of our analysis, and prior evaluations, is the lack of data on the changes to premises' serving hours experienced by consumers following the Act. We therefore cannot quantify the link between the magnitude of changes in availability and the outcomes studied. We were also unable to evaluate similar legislation introduced in Scotland in 2009 [Licensing (Scotland) Act 2005]. Although Alcovision continued to collect data after 2008, a break in the data series between 2008 and 2009 to switch from in-street to on-line sampling means that we did not have access to comparable pre-intervention data to allow a robust evaluation.

Despite the Licensing Act 2003 deregulating trading hours in England and Wales, this study has found that the Act had only limited effects on the characteristics of drinking occasions. Future research should evaluate changes in alcohol availability by collecting local data on changes in trading hours to permit quantification of the direct effects of the policy. It should also collect data on drinking occasions, to validate our unique analysis in additional contexts and develop understanding of how changes in availability affect characteristics of drinking occasions, consumption and harm. More broadly, policymakers should state clear intentions and a theory of change for policy measures. This would facilitate the inclusion of proximal outcomes in policy evaluations, informing the refinement of ineffective policies.

## Declaration of interests

J.H. has received research funding from Systembolaget and Alko, the government-owned alcohol retail monopolies in Sweden and Finland. P.S.M. has also received research funding from Alko.

## Acknowledgements

This paper presents independent research funded by the National Institute for Health Research (NIHR) School for Public Health Research (SPHR; PD-SPH-2015), the University of Sheffield and the Economic and Social Research Council (ES/R005257/1). The views expressed are those of the author(s) and not necessarily those of the NIHR or the Department of Health and Social Care. F.deV. is partly funded by National Institute for Health Research Applied Research Collaboration West (NIHR ARC West) and the National Institute for Health Research School for Public Health Research.

## Data accessibility statement

The Alcovision survey is a commercial product and therefore cannot be made publically accessible.

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## Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

**Table S1** Supplementary table for all drinkers.
**Table S2** Supplementary table for on-trade or mixed drinking occasions of under 25 year olds.
**Table S3** Supplementary table for on-trade or mixed drinking occasions at the weekend.
**Table S4** Supplementary table for on-trade or mixed drinking occasions.
**Table S5** Supplementary table for off-trade drinking occasions at the weekend.
**Table S6** Supplementary table for drinking occasions of under 25 year olds.
**Table S7** Supplementary table for drinking occasions at the weekend.
**Table S8** Supplementary table for drinking occasions of over 25 year olds.
**Table S9** Supplementary table for drinking occasions of those in full-time employment at the weekend and during the week.
**Appendix A.** Supporting information.

 